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(12) **United States Patent**
Nelson

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(54) **FIBER OPTIC ADAPTER WITH INTEGRALLY MOLDED FERRULE ALIGNMENT STRUCTURE**

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(72) Inventor: **Keith Nelson**, Brooklyn Center, MN (US)

(73) Assignee: **CommScope Technologies LLC**, Hickory, NC (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

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(65) **Prior Publication Data**

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Related U.S. Application Data

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G02B 6/38 (2006.01)

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CPC ***G02B 6/3869*** (2013.01); ***G02B 6/381*** (2013.01); ***G02B 6/3825*** (2013.01);
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(58) **Field of Classification Search**
None
See application file for complete search history.

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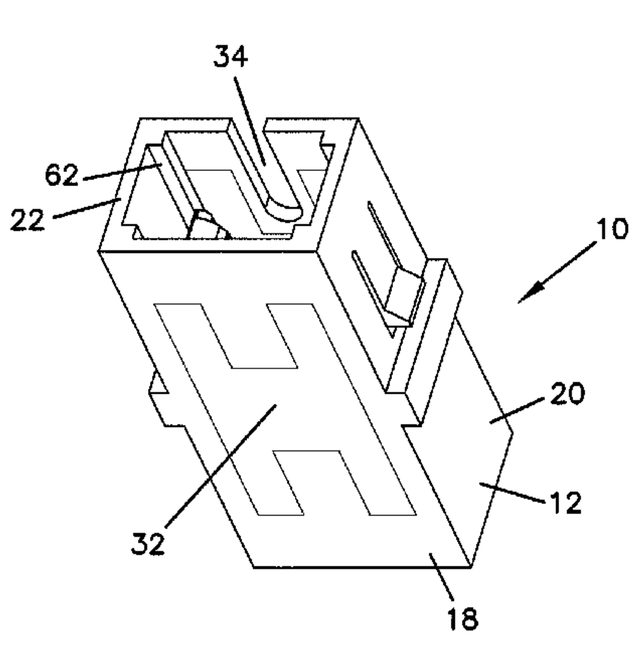
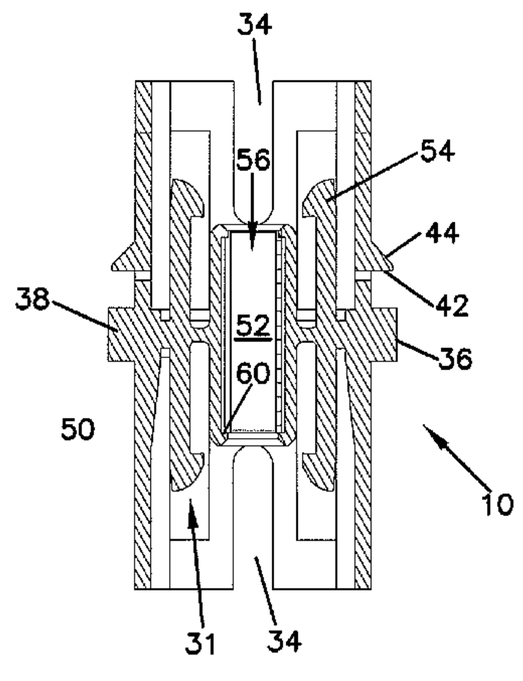
Primary Examiner — Michelle R Connelly
(74) *Attorney, Agent, or Firm* — Merchant & Gould P.C.

(57) **ABSTRACT**

A fiber optic adapter is disclosed. The fiber optic adapter includes a main body configured to receive a first fiber optic connector through a first end and a second fiber optic connector through a second end for mating with the first fiber optic connector. The adapter includes a ferrule alignment structure located within an axial cavity of the main body, the ferrule alignment structure including a sleeve mount and a ferrule sleeve, the sleeve mount including an axial bore and at least one latching hook extending from a center portion of the sleeve mount toward the first end of the main body and at least one latching hook extending from the center portion toward the second end of the main body, the latching hooks configured to flex for releasably latching the first and second fiber optic connectors to the fiber optic adapter. The sleeve mount and the main body of the fiber optic adapter are unitarily molded as a single piece and the ferrule sleeve is separately placed within the axial bore of the sleeve mount.

14 Claims, 6 Drawing Sheets





Related U.S. Application Data

continuation of application No. 12/548,121, filed on Aug. 26, 2009, now Pat. No. 8,382,382.

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(52) **U.S. Cl.**
CPC ***G02B 6/3831*** (2013.01); ***G02B 6/3833*** (2013.01); ***G02B 6/3834*** (2013.01); ***G02B 6/3851*** (2013.01); ***G02B 6/3865*** (2013.01); ***G02B 6/3873*** (2013.01); ***G02B 6/3874*** (2013.01)

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FIG. 1

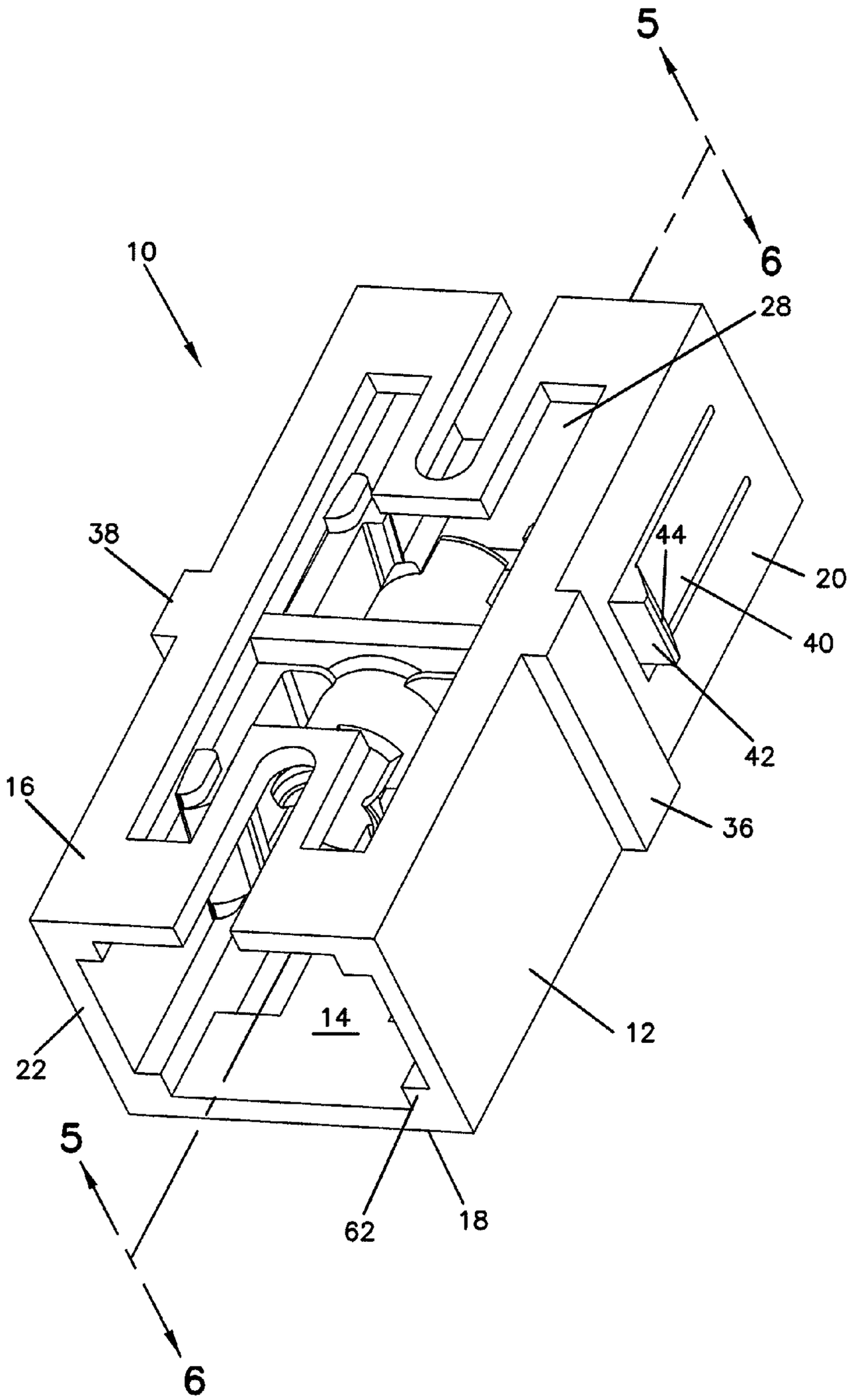


FIG. 1A

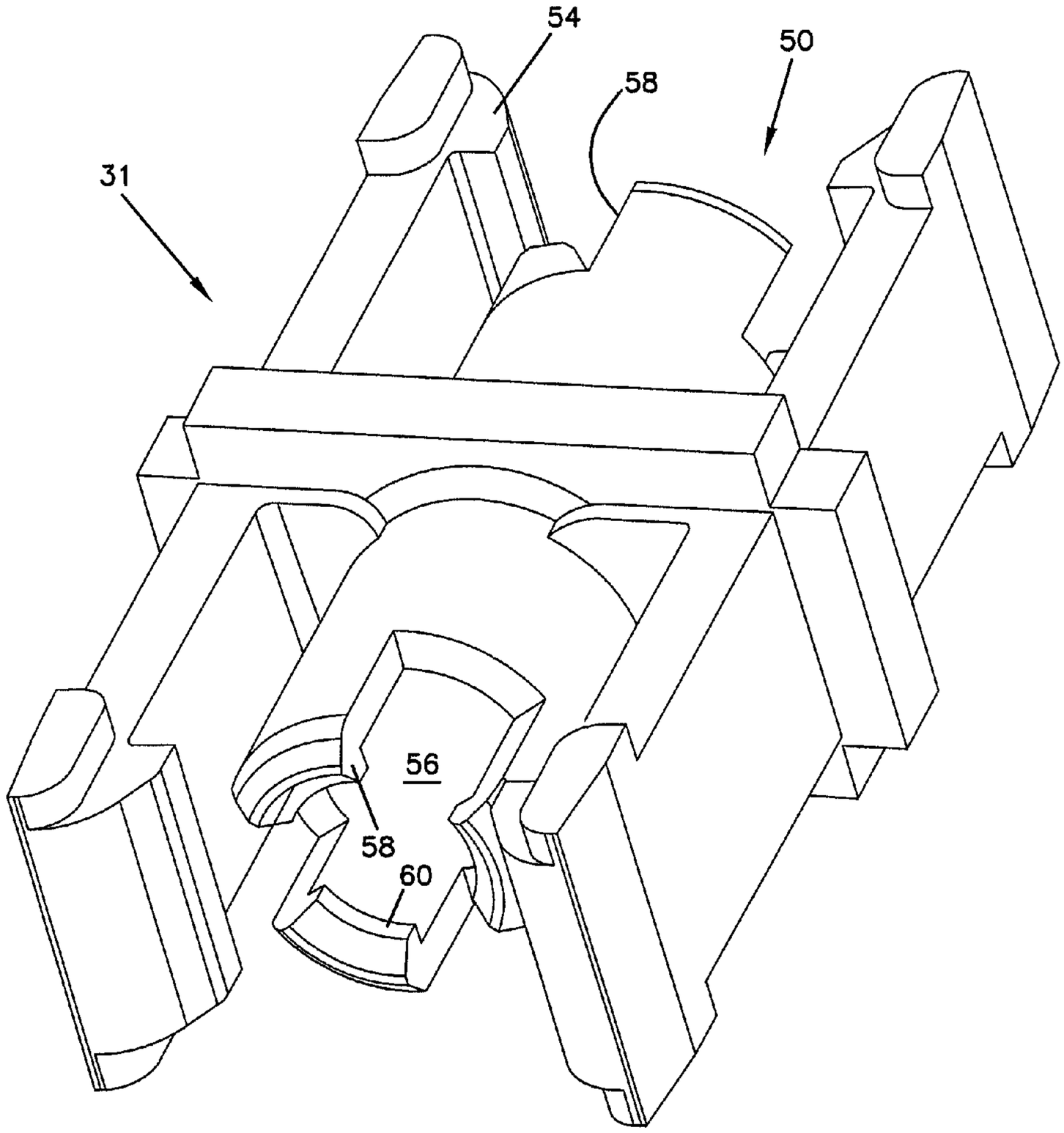


FIG. 2

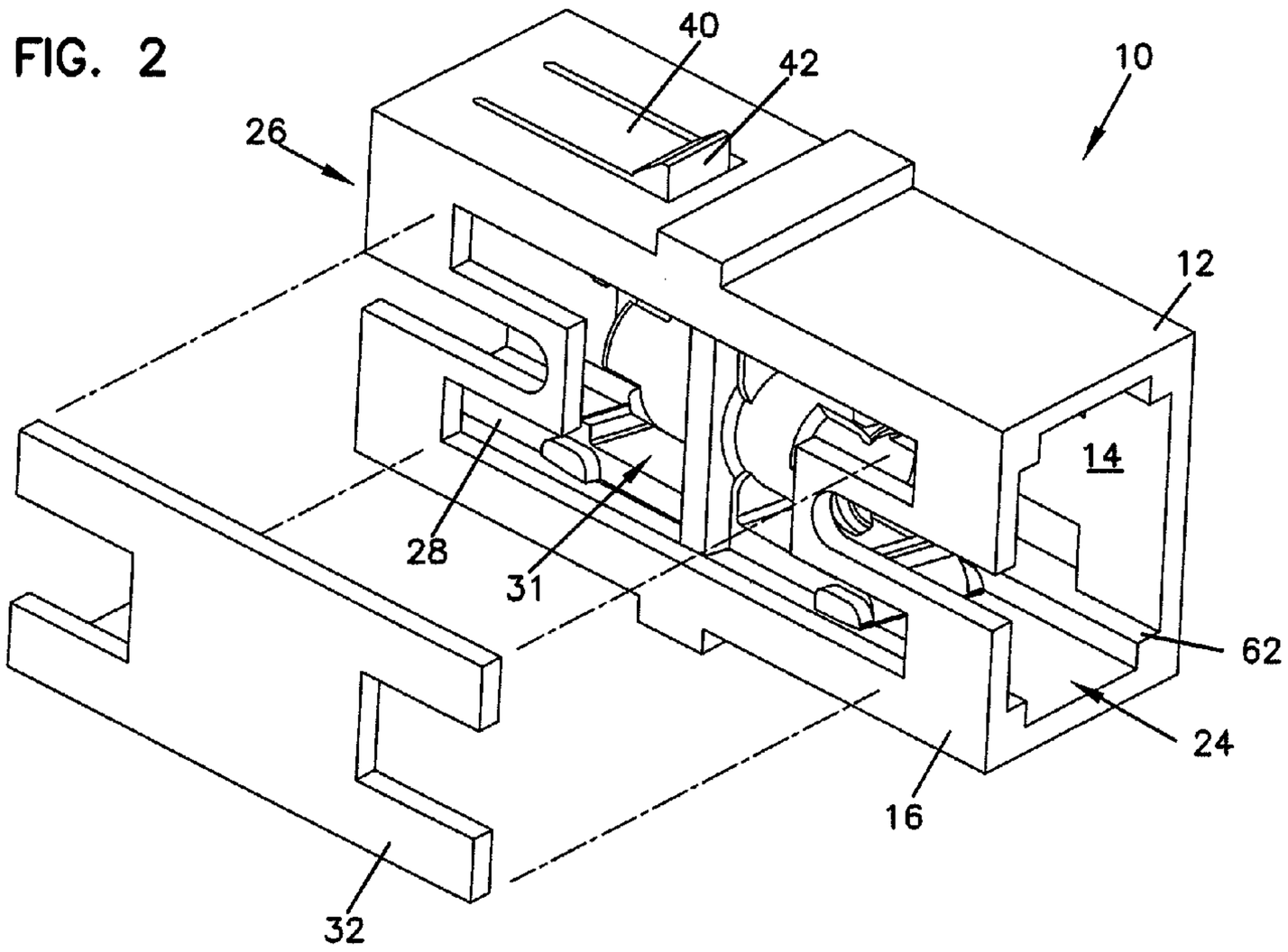
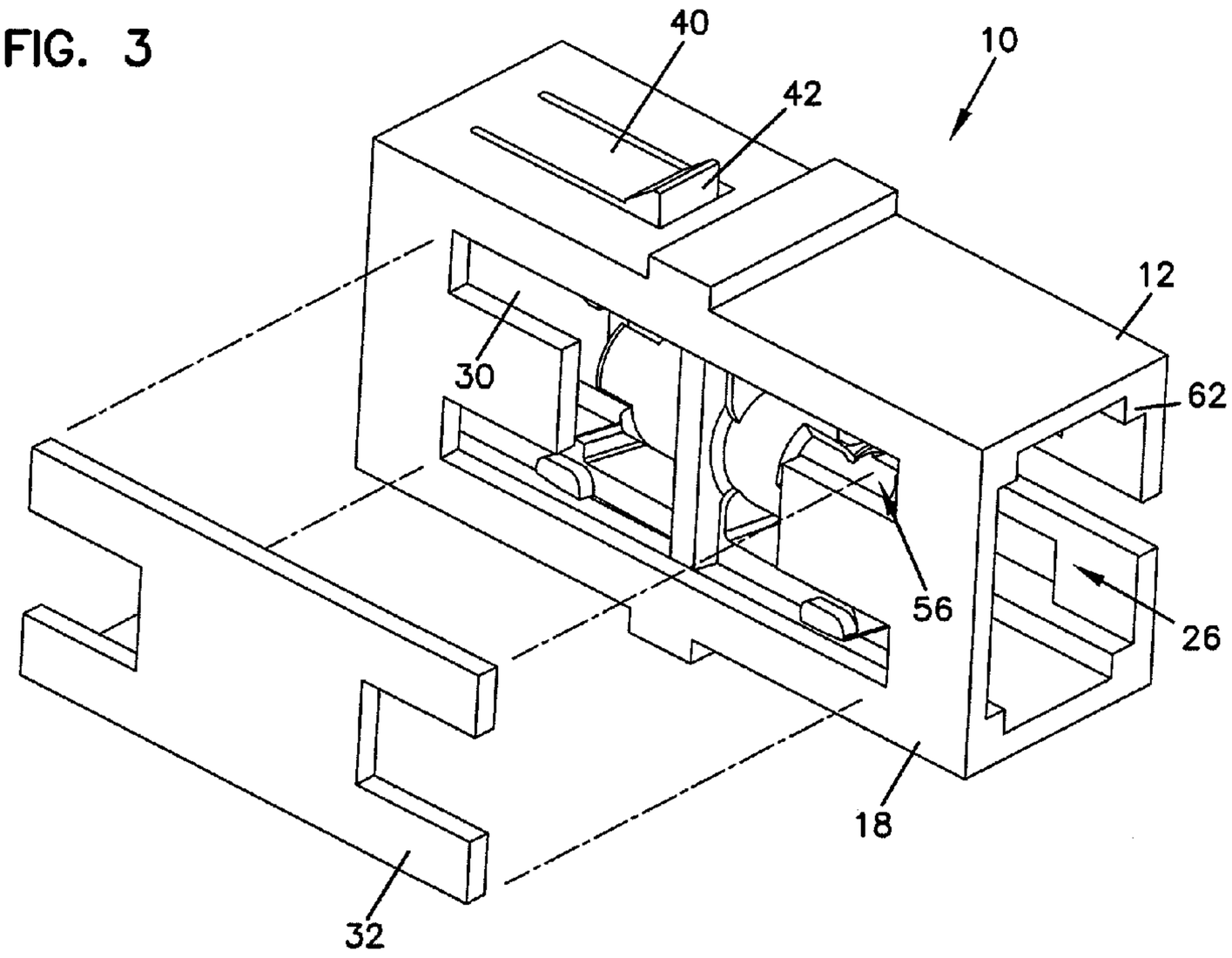


FIG. 3



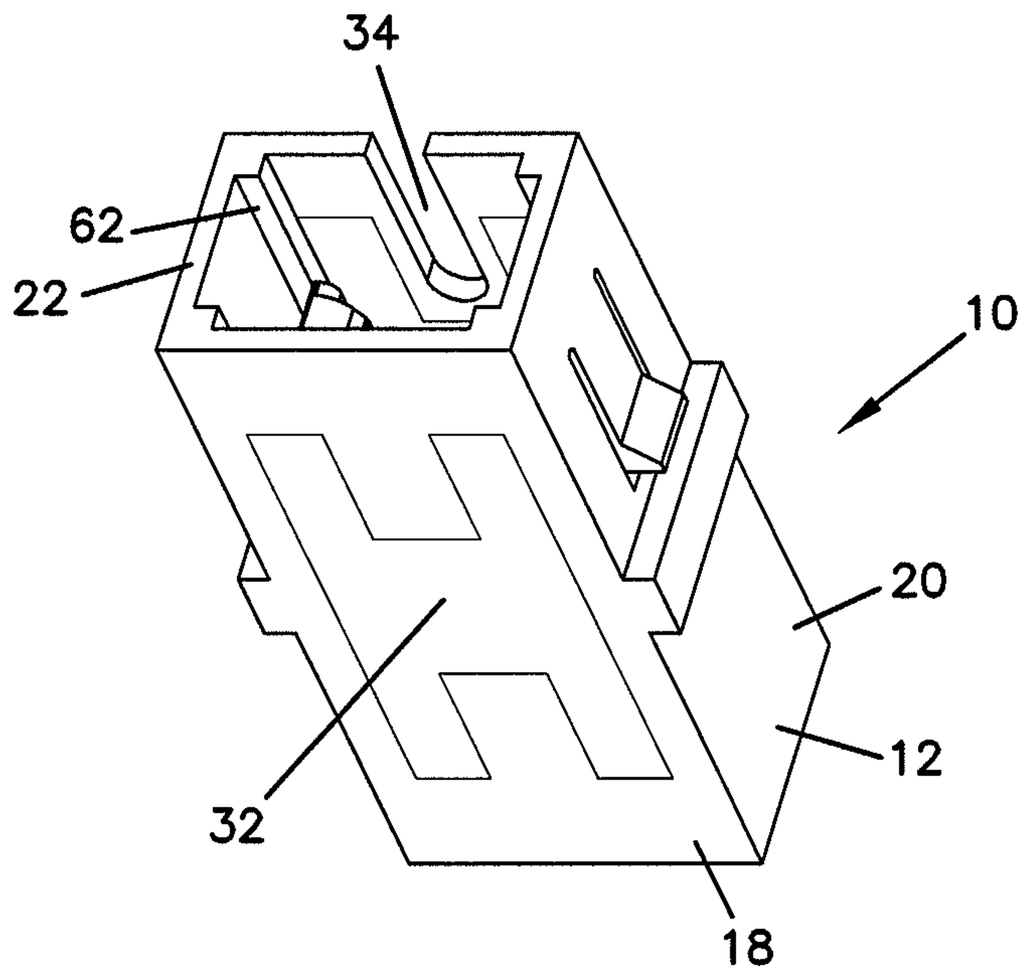


FIG. 4

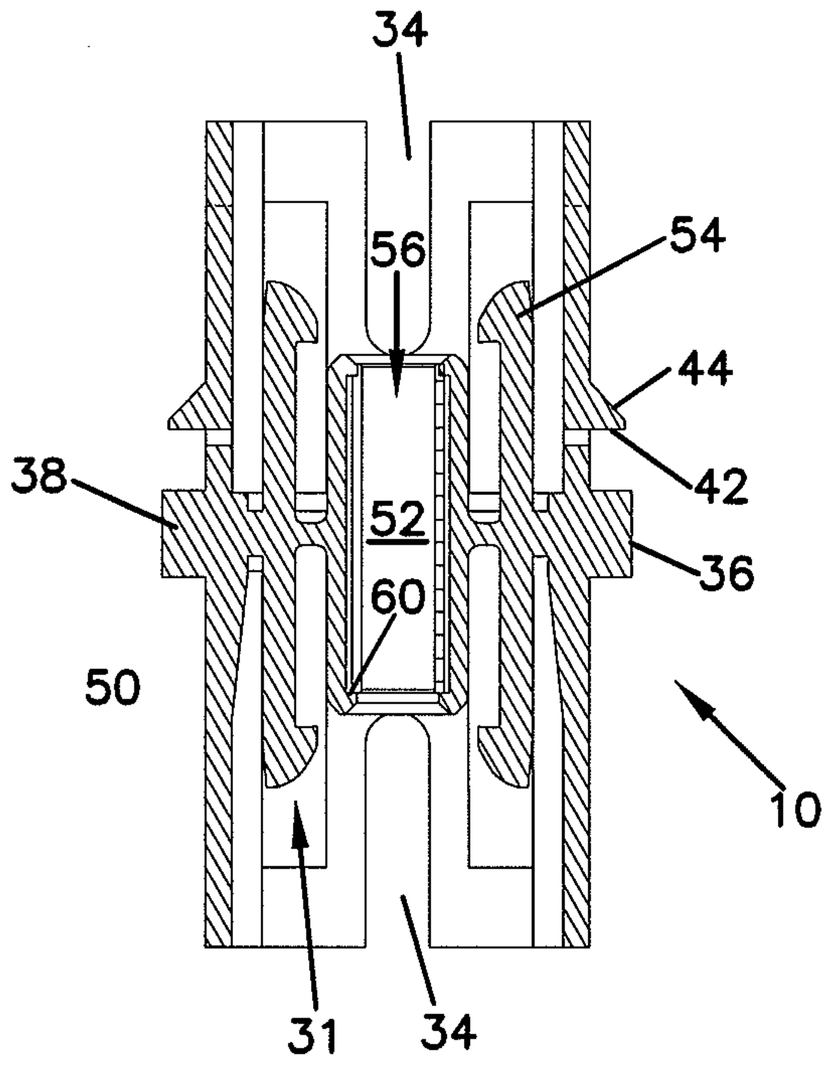


FIG. 5

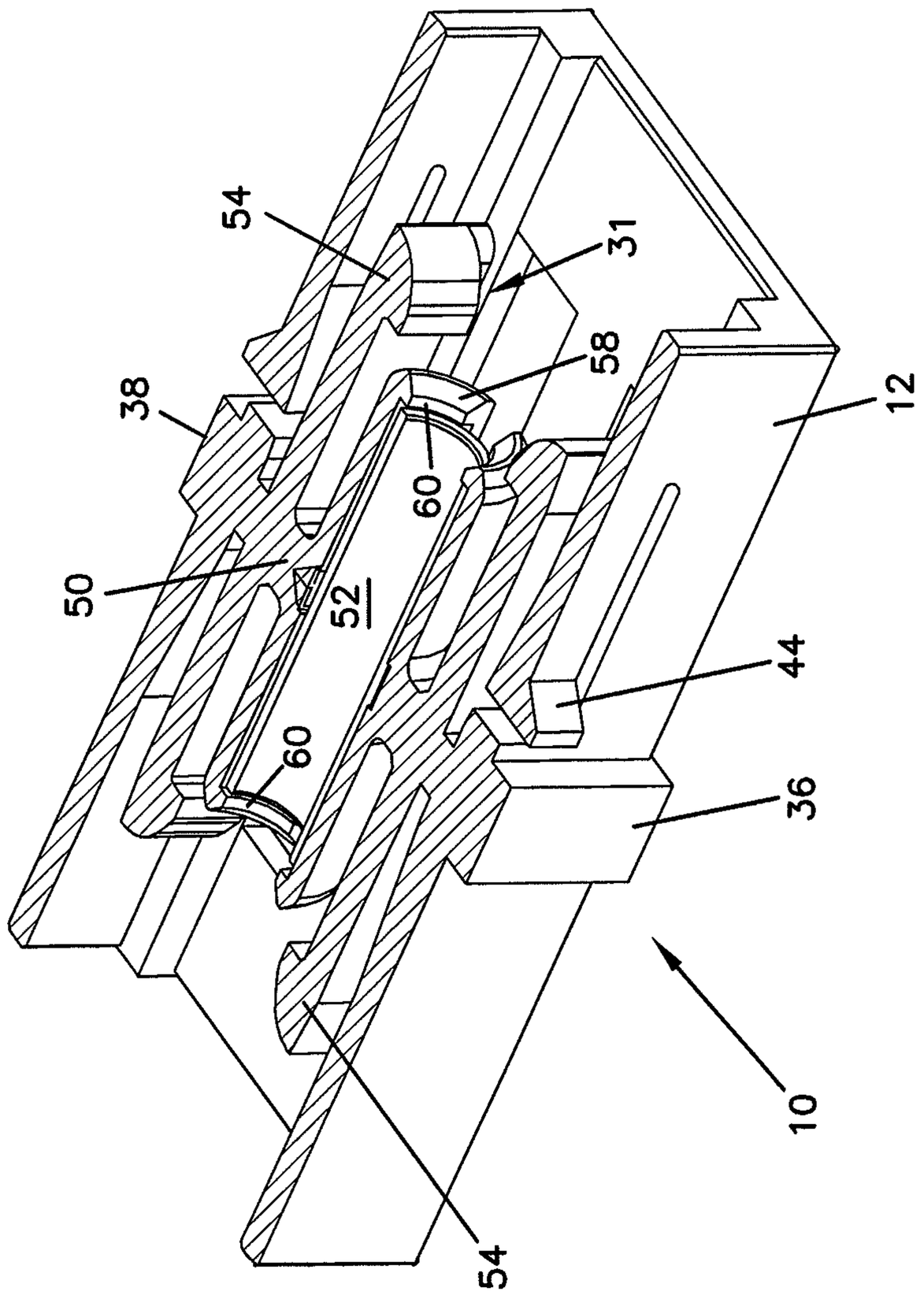


FIG. 6

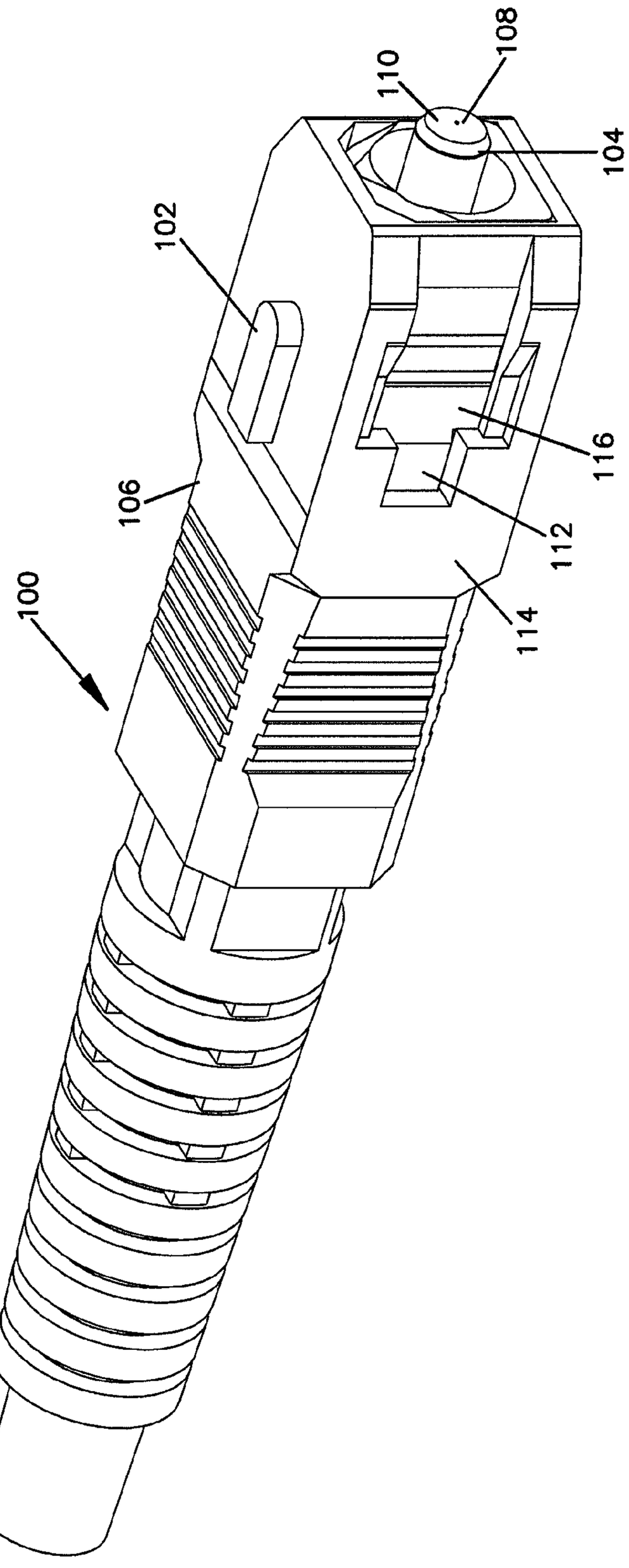


FIG. 7

FIBER OPTIC ADAPTER WITH INTEGRALLY MOLDED FERRULE ALIGNMENT STRUCTURE

CROSS REFERENCE TO RELATED APPLICATIONS

This application is a continuation of application Ser. No. 14/499,594, now U.S. Pat. No. 8,992,095, which is a continuation of application Ser. No. 13/777,575, filed Feb. 26, 2013, now U.S. Pat. No. 8,845,205, which is a continuation of application Ser. No. 12/548,121, filed Aug. 26, 2009, now U.S. Pat. No. 8,382,382, which application claims the benefit of provisional application Ser. No. 61/092,166, filed Aug. 27, 2008, which applications are incorporated herein by reference in their entirety.

FIELD

The present disclosure relates generally to fiber optic adapters. In particular, the present disclosure relates to fiber optic adapters having bodies with integrally molded ferrule alignment features.

BACKGROUND

Fiber optics have revolutionized communication throughout the world. Fiber optics are generally thin strings of glass designed to carry light which can be grouped together. With the increased use of fiber optics, it has become increasingly important to be able to connect and disconnect fiber optic cables from various sources. Two fiber optic cables can be optically coupled so that they are in communication with one another by using well-known connectors and adapters, thereby putting each fiber optic cable in communication with the other. The connectors are terminated to the end of each cable and then plugged into the adapters. The adapters normally include an opening at each end designed to receive the connectors. An example adapter for holding two SC-type mating connectors is described in U.S. Pat. No. 5,317,663. Improvements in the design and manufacture of fiber optic adapters are desirable.

SUMMARY

The present disclosure relates generally to fiber optic adapters configured to receive fiber optic connectors having ferrules, wherein the ferrule alignment structures of the adapters are integrally molded as a unitary piece with the adapter body.

In one particular aspect, the present disclosure relates to a fiber optic adapter including a main body configured to receive a first fiber optic connector through a first end and a second fiber optic connector through a second end for mating with the first fiber optic connector, the adapter including a ferrule alignment structure located within an axial cavity of the main body, the ferrule alignment structure including a sleeve mount and a ferrule sleeve, the sleeve mount including an axial bore and at least one latching hook extending from a center portion of the sleeve mount toward the first end of the main body and at least one latching hook extending from the center portion toward the second end of the main body, the latching hooks configured to flex for releasably latching the first and second fiber optic connectors to the fiber optic adapter, wherein the sleeve mount and the main body of the fiber optic adapter are unitarily molded as a single piece and the ferrule sleeve is separately placed within the axial bore of the sleeve mount, the ferrule sleeve configured to receive and align ferrules of the first and second fiber optic connectors.

A variety of additional inventive aspects will be set forth in the description that follows. The inventive aspects can relate to individual features and combinations of features. It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory only and are not restrictive of the broad inventive concepts upon which the embodiments disclosed herein are based.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of a fiber optic adapter having features that are examples of inventive aspects in accordance with the principles of the present disclosure, the fiber optic adapter shown without the top and bottom cover panels thereof;

FIG. **1**A illustrates the internal ferrule alignment features of the fiber optic adapter of FIG. **1** separately from the main body of the fiber optic adapter;

FIG. **2** illustrates the fiber optic adapter of FIG. **1** with one of the cover panels exploded from the body of the fiber optic adapter;

FIG. **3** illustrates the fiber optic adapter of FIG. **2** with the opposing cover panel exploded from the body of the fiber optic adapter;

FIG. **4** is another perspective view of the fiber optic adapter of FIG. **1**, with the cover panels mounted thereon;

FIG. **5** is a cross-sectional view of the fiber optic adapter taken along line **5-5** of FIG. **1**;

FIG. **6** is a cross-sectional view of the fiber optic adapter taken along line **6-6** of FIG. **1**; and

FIG. **7** is a perspective view of an example fiber optic connector for use with the fiber optic adapter of FIGS. **1-6**.

DETAILED DESCRIPTION

Reference will now be made in detail to examples of inventive aspects of the present disclosure which are illustrated in the accompanying drawings. Wherever possible, the same reference numbers will be used throughout the drawings to refer to the same or like parts.

Referring to FIGS. **1-6**, a fiber optic adapter **10** having features that are examples of inventive aspects in accordance with the principles of the present disclosure is shown. In the depicted embodiment, the fiber optic adapter **10** is configured to intermate SC-type connectors, one of which is shown in FIG. **7** of the present application and also shown and described in U.S. Pat. Nos. 5,317,663 and 6,712,523, the entire disclosures of which are incorporated herein by reference. However, it should be noted that the SC-type fiber optic adapter **10** described herein represents only one example embodiment of the inventive features of the disclosure and that the inventive features may be applicable to adapters configured to be used with other types of connectors (e.g., LC, LX.5, etc.). The inventive features should not be limited only to the specific embodiments described and illustrated herein.

Still referring to FIGS. **1-6**, the fiber optic adapter **10** includes a main body **12** including an axial cavity **14** that is defined by a top side-wall **16**, a bottom side-wall **18**, a right side-wall **20**, and a left side-wall **22**. The axial cavity **14** of the main body **12** extends between a first opening **24** and a second opening **26**. Each opening **24**, **26** is sized to receive a fiber optic connector **100**.

Since the embodiment of the adapter described herein is configured for use with SC-type connectors, the main body **12**

and the axial cavity **14** are specifically sized and configured to accommodate SC-type connectors.

Referring now to FIGS. **1-3**, the main body **12** of the fiber optic adapter **10** includes a first opening **28** at the top side and a second opening **30** at the bottom side thereof. As will be discussed in further detail below, the first and second openings **28**, **30** allow the fiber optic adapter main body **12** and at least a portion of the internal ferrule alignment structures **31** (see FIG. **1**A) that are located within the main body **12** to be injection-molded as a unitary piece. The first and second openings **28**, **30** are covered by a pair of cover panels **32** after the fiber optic adapter **10** has been unitarily molded. The cover panels **32** may be ultrasonically welded to the main body **12** of the adapter **10**.

Preferably, the first opening **28** and the second opening **30** are of the same configuration such that the cover panels **32** used for the first opening **28** and the second opening **30** are also of the same size and shape. In this manner, the cover panels **32** for both the top and the bottom sides of the adapter **10** can be produced using the same mold/tool, reducing manufacturing costs.

Still referring to FIGS. **1-3**, located in the bottom side-wall **18** is a keyway **34** sized and shaped to receive a corresponding key **102** of an SC-type fiber optic connector **100** shown in FIG. **7** and discussed below.

Located on the exterior of the main body **12** are tabs **36**, **38**. Tab **36** is located on right side-wall **20** and tab **38** is located on left side-wall **22**. The tabs **36**, **38** are operative in supporting the adapter **10** on or against a planar surface such as that of a bulkhead. The main body **12** also includes a flexible cantilever arm **40** on each of the right side-wall **20** and left side-wall **22**. The flexible cantilever arms **40** define outwardly protruding tabs **42** that are configured to cooperate with the tabs **36**, **38** to capture the fiber optic adapter **10** against a bulkhead. The tabs **42** of the cantilever arms **40** include ramped surfaces **44** to facilitate insertion of the fiber optic adapter **10** into an aperture defined by the bulkhead structure. The ramped surfaces **44** cause the flexible cantilever arms **40** to flex inwardly as the adapter **10** is moved passed the aperture of the bulkhead.

Although in the preferred embodiment the adapter **10** includes integrally molded flexible cantilever arms **40**, if desired, in other alternative embodiments, other types of fasteners such as a flexible clip shown and described in U.S. Pat. No. 5,317,663 may be used. Recesses may be provided on the main body **12** and the cover panels **32** to permit the use of alternative fastener means such as the flexible clip.

Also, in other embodiments of the adapter, the tabs may be longer and include fastener openings. As such, screws or similar fasteners may be used to connect the fiber optic adapter to a bulkhead structure.

The attachment structures discussed herein are non-limiting examples and other removable or non-removable fastening structures such as snap fasteners, rivets, etc. may be used to attach adapter to a bulkhead structure.

Now referring to FIGS. **5** and **6**, as discussed above, the fiber optic adapter main body **12** and at least a portion of the internal ferrule alignment features **31** of the adapter **10** are injection-molded as a unitary piece, and cover panels **32** are used to cover the first and second openings **28**, **30** after the adapter **10** has been molded. In FIGS. **5** and **6**, the internal ferrule alignment components **31** of the SC-type adapter **10** are shown via cross-sectional views. Also, although the internal ferrule alignment features **31** are molded integrally with the main body **12** of the fiber optic adapter **10**, FIG. **1**A illustrates the internal ferrule alignment features of the fiber optic adapter of FIG. **1** separately from the main body of the fiber optic adapter for ease of description and clarity.

The internal ferrule alignment structures **31** include a sleeve mount **50** and a ferrule sleeve **52** that is designed to be inserted within the sleeve mount **50**. As shown in FIGS. **5** and **6**, the sleeve mount **50** is molded integrally with the adapter body **12** and is configured to align the ferrules **104** of two SC-type fiber optic connectors **100** (FIG. **7**) received from opposing ends of the adapter body **12** for interconnection.

The sleeve mount **50** includes latching hooks **54**, an axial bore **56**, and flexible arms **58** defined around the axial bore **56**. Once the sleeve mount **50** is molded integrally with the main body **12** of the adapter **10**, the ferrule sleeve **52** is received within the axial bore **56** of the sleeve mount **50**. The flexible arms **58** flex out radially to receive the sleeve **52** with a snap fit arrangement. The flexible arms **58** include inwardly extending fingers **60** for capturing the sleeve **52** within the axial bore **56** once the sleeve **52** is received therein (see FIGS. **5** and **6**). The sleeve **52** can be inserted into the axial bore **56** from either end of the sleeve mount **50**. In certain embodiments, the sleeve **52** may also include a slit for allowing the sleeve **52** to compress, elastically reducing its diameter during insertion into the axial bore **56**.

It should be noted that the flexible arms **58** located at one end of the sleeve mount **50** may be positioned at an offset relationship to the flexible arms **58** located at the other end of the sleeve mount **50**. In this manner, the inwardly extending fingers **60** may be molded with molds/tools that are pulled apart from the ends of the fiber optic adapter in the longitudinal direction. During the molding process, the first and second openings **28**, **30** (see FIGS. **2-3**) allow certain features of the adapter **10** to be molded with molds/tools that are pulled apart in the transverse direction while features such as the inwardly extending fingers **60** are formed with molds/tools that pulled apart in the longitudinal direction of the fiber optic adapter **10**.

Still referring to FIGS. **1**A, **5** and **6**, the latching hooks **54** are configured to cooperate with the housing **106** of an SC-type connector **100** and are used for releasably latching connectors **100** to the adapter **10**, as will be described in further detail below.

Referring to FIGS. **4-6**, located on the interior of main body **12** are ridges **62**, extending longitudinally within the axial cavity **14** along the interior corners of the axial cavity **14**. The ridges **62** cooperate with the outer surface of a fiber optic connector housing **106** to receive the connector **100** within the axial cavity **14**. In certain embodiments, the ridges **62** may include ramped entry surfaces to facilitate insertion of the connector **100** within the adapter cavity **14**.

The main body **12** of the adapter **10** and the sleeve mount **50** may be constructed of a polymer by an injection molding process. It is contemplated that other materials and other molding processes may be used for the construction of the fiber optic adapter **10**.

FIG. **7** shows an SC-type fiber optic connector **100** that may be used with the fiber optic adapter **10** shown in FIG. **1-6**. Connector **100** includes an optical fiber **108** which is held therein by a ferrule **104**. The end of optical fiber is located on a contact face **110** of the ferrule **104**. Ferrule **104** is held within a housing **106** of the connector **100**. The housing **106** includes a first inner portion **112** and an axially slidable outer portion **114**. The housing **106** defines two slots **116** on opposite sides thereof and a key **102** located on a side perpendicular to the sides containing the slots **116**. As discussed previously, the key **102** is configured to engage the keyway **34** of fiber optic adapter main body **12** to properly position connector **100** through the first opening **28** of the adapter **10**. When

properly positioned within the axial cavity **14** of adapter **10**, the ferrule **104** is received within the ferrule sleeve **52** inside the sleeve mount **50** of the adapter **10**.

As is known in the art, when a first connector **100** is fully inserted into the adapter **10**, the flexible latching hooks **54** of the sleeve mount **50** of the adapter engage the slots **116** in the outer portion **114** of the connector housing **106** to releasably hold connector **100** within the axial cavity **14** of adapter **10**. When a second connector **100** is inserted into the opposing side of adapter **10**, an optical connection is formed between the optical fiber of the first connector **100** and the optical fiber of the second connector **100** through the abutting contact faces **110** of the ferrules **114** within the ferrule sleeve **52**.

When removing one of the fiber optic connectors **100**, the slidable outer portion **114** of the connector housing **106** is slid axially relative to the first inner portion **112** of the connector housing **106** away from the opposing connector until the flexible latching hooks **54** of the adapter **10** are released from the slots **116** defined on the housing **106** of the connector **100**, as is known in the art.

As discussed previously, the illustrated embodiment shows an SC-type fiber optic adapter **10** for receiving SC-type fiber optic connectors **100**. It is anticipated that the inventive features of the present disclosure can be utilized with other types, sizes and designs of adapters and connectors.

Although in the foregoing description of the fiber optic adapter **10**, terms such as "top", "bottom", "upper", "lower", "front", "back", "right", and "left" were used for ease of description and illustration, no restriction is intended by such use of the terms. The fiber optic adapter **10** can be used in any orientation.

Having described the preferred aspects and embodiments of the present disclosure, modifications and equivalents of the disclosed concepts may readily occur to one skilled in the art. However, it is intended that such modifications and equivalents be included within the scope of the claims which are appended hereto.

What is claimed is:

1. A method of manufacturing a fiber optic adapter for interconnecting two fiber optic connectors in coaxial alignment, each connector including a generally cylindrical ferrule holding an end of an optical fiber, wherein the adapter includes a main body with an axial cavity defined by a top side-wall, a bottom side-wall, a right side-wall, and a left side-wall, the axial cavity extending between a first opening defined at a first end of the main body and a second opening defined at a second end of the main body, the first end configured to receive a first fiber optic connector through the first opening, and the second end configured to receive a second fiber optic connector through the second opening for mating with the first fiber optic connector, wherein the adapter also includes a ferrule alignment structure including a sleeve mount for receiving a ferrule-alignment sleeve, the sleeve mount defining a first end, a second end, and a center portion, wherein the first end of the sleeve mount is positioned toward the first end of the main body and the second end of the sleeve mount is positioned toward the second end of the main body, the sleeve mount defining an axial bore that defines a longitudinal axis extending from the first end of the sleeve mount toward the second end of the sleeve mount, the axial bore configured to receive and coaxially align the ferrules of the fiber connectors when the fiber connectors are inserted into the adapter, wherein the sleeve mount includes a first portion extending from the center portion of the sleeve mount toward the first end of the sleeve mount and a second portion extending from the center portion of the sleeve mount toward the second end of the sleeve mount, each of the first and second portions defining an inwardly extending finger for capturing the ferrule-alignment sleeve within the axial bore once the sleeve is received within the bore, the method comprising:

molding the main body of the fiber optic adapter and the sleeve mount as a unitary structure.

2. A method according to claim **1**, further comprising using a molding tool for molding the main body and the sleeve mount of the fiber optic adapter such that parts of the molding tool are pulled apart from the first and second ends of the main body along a direction of the longitudinal axis.

3. A method according to claim **2**, wherein the sleeve mount includes at least three flexible arms.

4. A method according to claim **1**, further comprising inserting a ferrule-alignment sleeve into the axial bore of the sleeve mount from one of the first end and the second end of the sleeve mount.

5. A method according to claim **4**, wherein the ferrule-alignment sleeve is inserted within the axial bore after the main body and the sleeve mount have been unitarily molded.

6. A method according to claim **1**, further comprising molding the sleeve mount such that at least one of the first portion and the second portion of the sleeve mount defines flexible arms defined around the axial bore of the sleeve mount for receiving a ferrule-alignment sleeve, the flexible arms configured to flex out radially to receive the ferrule-alignment sleeve into the axial bore after the sleeve mount and the main body have been unitarily molded.

7. A method according to claim **1**, wherein the main body and the sleeve mount are molded out of a polymer.

8. A method according to claim **1**, wherein the adapter includes an outwardly protruding mounting tab on each of the right side-wall and the left side-wall.

9. A method according to claim **1**, further comprising molding the sleeve mount such that the inwardly extending finger of the first portion is positioned around the axial bore at a peripherally offset relationship with respect to the inwardly extending finger of the second portion along the longitudinal axis defined by the axial bore.

10. A method according to claim **9**, further comprising molding three inwardly extending fingers for each of the first portion and the second portion.

11. A method according to claim **1**, wherein the manufactured fiber optic adapter is configured for interconnecting two SC type fiber connectors in coaxial alignment.

12. A method according to claim **1**, further comprising molding the main body and the sleeve mount out of a polymer.

13. A method according to claim **1**, further comprising molding an outwardly protruding mounting tab on each of the right side-wall and the left side-wall of the main body.

14. A method according to claim **1**, wherein the sleeve mount includes two latching hooks extending from the center portion of the sleeve mount toward the first end of the main body and two latching hooks extending from the center portion of the sleeve mount toward the second end of the main body, wherein the latching hooks extending toward the first end of the main body are positioned on opposite sides of the axial bore and are configured to flex toward and away from each other to releasably latch a first connector to the adapter, and the latching hooks extending toward the second end of the main body are positioned on opposite sides of the axial bore and are configured to flex toward and away from each other to releasably latch a second connector to the adapter.

* * * * *